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**National Astronomy and Ionosphere Center**  
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March 17, 1994

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Ms. Donna R. Searcy  
Secretary  
Federal Communications Commission  
1919 M Street, N.W., Room 222  
Washington, D.C. 20554

Dear Ms. Searcy:

On behalf of Cornell University, transmitted herewith are an original and nine (9) copies of its Comments in response to the Petition for Rule Making and a Request for an Immediate Waiver (RM. 8435) by Western Multiplex Corporation.

Should any question arise concerning this issue, please communicate with the undersigned at the Arecibo Observatory.

Very truly yours,



Dr. Willem A. Baan  
Frequency Manager, and  
Senior Research Associate

cc: Dr. Paul Goldsmith, Director, NAIC  
Dr. Daniel Altschuler, Director, Arecibo Observatory  
Dr. Donald Campbell, Cornell University  
Dr. Michael Davis, Arecibo Observatory  
Dr. Tomas Gergely, National Science Foundation  
Michael Kimberly, Acting University Council, Cornell  
Barry Lambergman, Esq., Fletcher Heald and Hildreth

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BEFORE THE  
**Federal Communications Commission**

WASHINGTON, D.C. 20554

In the Matter of )

Petition for Rulemaking by )

Western Multiplex Corporation for )

Amendment of Part 15 of the )

Commission's Rules with Regard to the )

Operation of Spread Spectrum Transmitters )

with Directional Antennas )

RM - 8435

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COMMENTS OF CORNELL UNIVERSITY

I. Introduction

Cornell University ("Cornell"), which operates the Arecibo Observatory ("the Observatory") near Arecibo, Puerto Rico under the terms of a cooperative agreement with the National Science Foundation, hereby offers its Comments on the above-captioned matter.

In its Petition for Rulemaking Western Multiplex Corporation proposes to amend the second sentence of Section 15.247(b) of the Commission's Rules as follows:

**Original Wording:** "If transmitting antennas of directional gain greater than 6 dBi are used, the power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi."

**Proposed Wording:** "If transmitting antennas of directional gain greater than 6 dBi are used with equipment operating in the frequency band 902-928 MHz, the power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi."

This change would eliminate the restriction of these unlicensed and unregulated devices to 6 dBw Effective Isotropic Radiated Power (EIRP) in the bands 2400-2483.5 MHz and 5725-5850 MHz. A modest antenna, such as a TV satellite antenna, can easily provide an EIRP of many kilowatts in these frequency bands with a 1-watt transmitter.

As explained below, Cornell is concerned about the interference that these spread spectrum emissions could cause to planetary radar studies being conducted at the Observatory at 2380 MHz. This comes at a time when the planetary radar capabilities at Arecibo Observatory are being upgraded at a significant cost to the taxpayer. Radar echos of planetary surfaces contain unique information about the surface properties, the orbit, and the size of the planetary object. This radar technique has been successfully applied to all nearby planets as well as comets and asteroids.

## II. Radar Studies at the Observatory

The Arecibo Observatory, which is part of the National Astronomy and Ionosphere Center (a federally owned national research center) is the largest radio/radar telescope in the world. The replacement cost today is estimated at \$100 million. The annual operating budget, supplied by the NSF and supplemented for planetary radar research by NASA, is currently \$8 million.

A new Gregorian Upgrade initiative aimed at upgrading the telescope for higher sensitivity and lower system temperatures is presently underway and is being funded by the NSF and NASA for \$24 million. The Upgrade program centers on the replacement of one of the two antenna/receiver houses by a Gregorian subreflector system allowing operation from 300 MHz to 10 GHz. This subreflector system, serving as the secondary and tertiary in the optics, will be housed in an 83 ft diameter space frame. The Arecibo Observatory is by far the largest aperture radio/radar telescope in the world and plays a leading role as a versatile research instrument in radiophysics.

In the past years planetary studies have made use of a 450 kW S-band transmitter which, with the reflector's forward gain of 71 dB, is the world's most powerful radar. Achievements in this field include detailed maps of Venus, the recent discovery of ice caps on Mercury, and images of the large icy satellites of Jupiter. The potential danger to the Earth posed by small asteroids has recently received considerable publicity. The Arecibo 2380 MHz radar is one of two radar systems in the world capable of detecting these objects and providing the ability to predict their future orbits, and, for some of them, obtaining detailed images.

The present S-band radar at Arecibo operates at 2380 MHz using an instant-

neous bandwidth of 20 MHz. The ongoing Gregorian Upgrade program will result in a doubling of the power for the transmitter to 1 MW and a lowering of the system temperatures to allow extremely high time resolution (0.1 microsecond) measurements of such objects as rapidly moving nearby asteroids. NASA's interest in the Gregorian Upgrade lies specifically with the increased capabilities of the planetary radar program at the Observatory.

### III. Spread Spectrum Emissions Must Be Sufficiently Filtered In Order To Prevent Interference to Radar Astronomy Operations in the 2370-2390 MHz band.


Interference in the 2370-2390 MHz band can be caused by non-licensed spread spectrum systems operating in the 2400-2483.5 MHz band. Cornell is concerned that sideband emissions may spill into the band used for planetary radar astronomy. The planetary radar system is used in a distinct transmit-receive mode of coded pulsetrain signals and sideband emissions could interfere with the detection and decoding of the weak returning signal from the planetary object.

Sideband emission, if unfiltered, can extend beyond the lower frequency edge of the band. Depending on the location, antenna gain and beam direction of the transmitting system, it can add to the system temperature over the 2370-2390 MHz band of the Arecibo radar system and can potentially result in a significant decrease in sensitivity for the system. A deterministic component within the unfiltered sideband emission could be very harmful for planetary radar observations. Such spectral structure could mimic the type of information to be received from the planetary surface and will be particularly harmful in terms of detecting weak signals from comets and asteroids.

Considering that the devices operating in the 2400-2483.5 MHz band are unlicensed, it will be difficult to affect the operation of these devices in the immediate vicinity of the Arecibo Observatory. Accordingly, Cornell requests that the Commission not grant the Petition for Rule Making for *unlimited* EIRP for these unlicensed systems as proposed. Any increase granted in permissible EIRP should include a requirement for a corresponding reduction in radiation below the 2400 MHz band edge.

Respectfully submitted,

CORNELL UNIVERSITY

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